

Identification of Biological Scatterers and Radar Data Quality Control



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Motive of this study

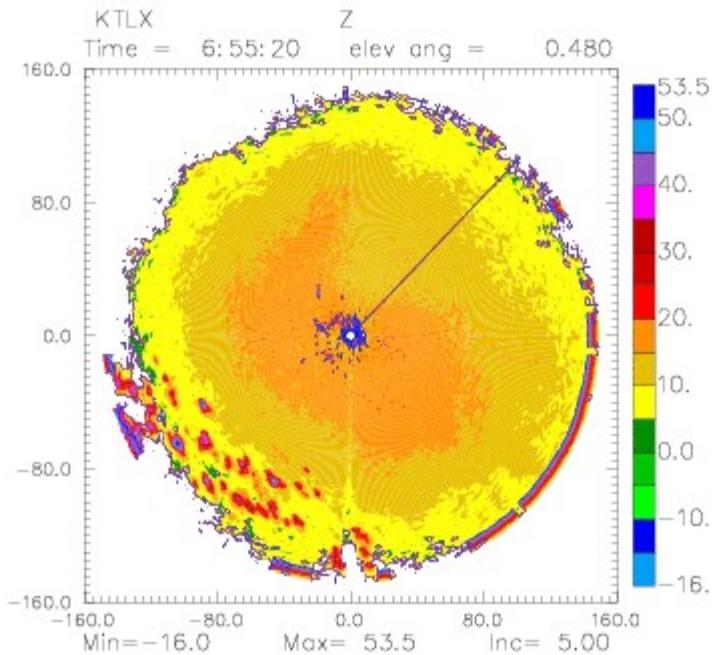


- VAD analysis
- Precipitation estimate
- Aviation safety

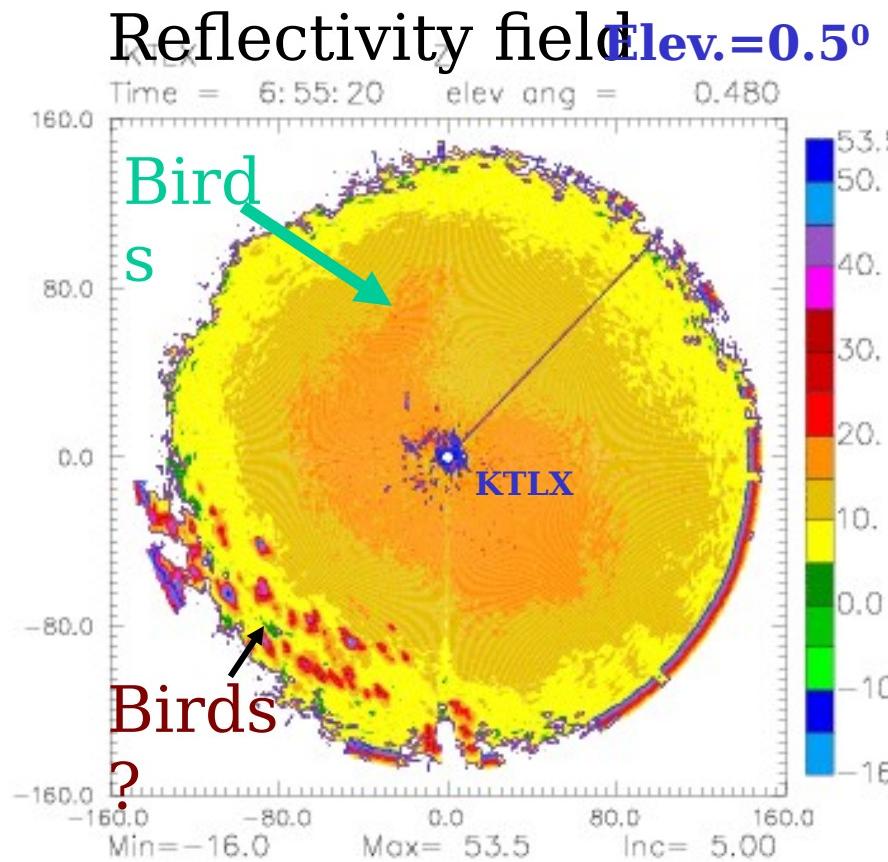
Biological Scatterers



Birds and
insects



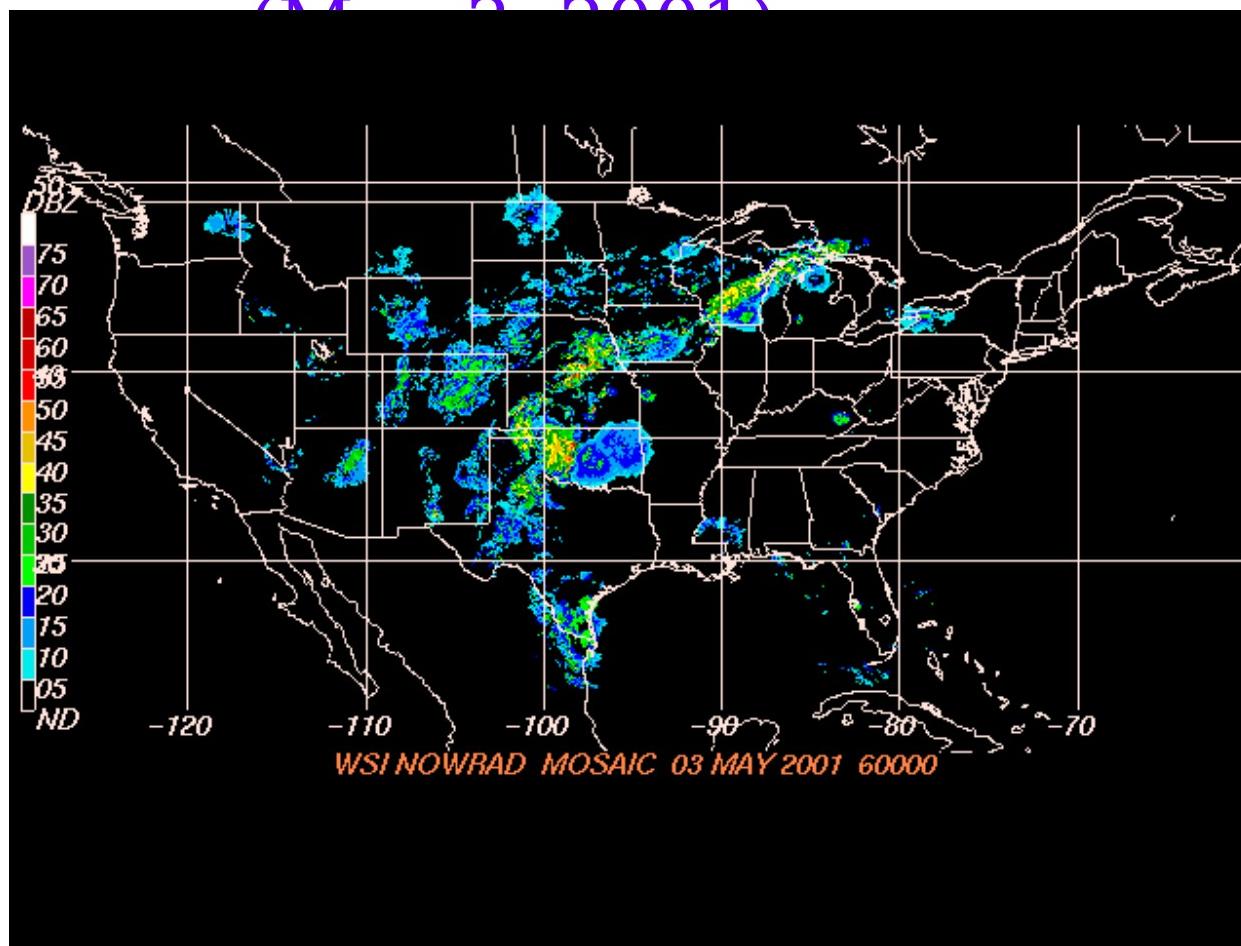
Bird Echoes



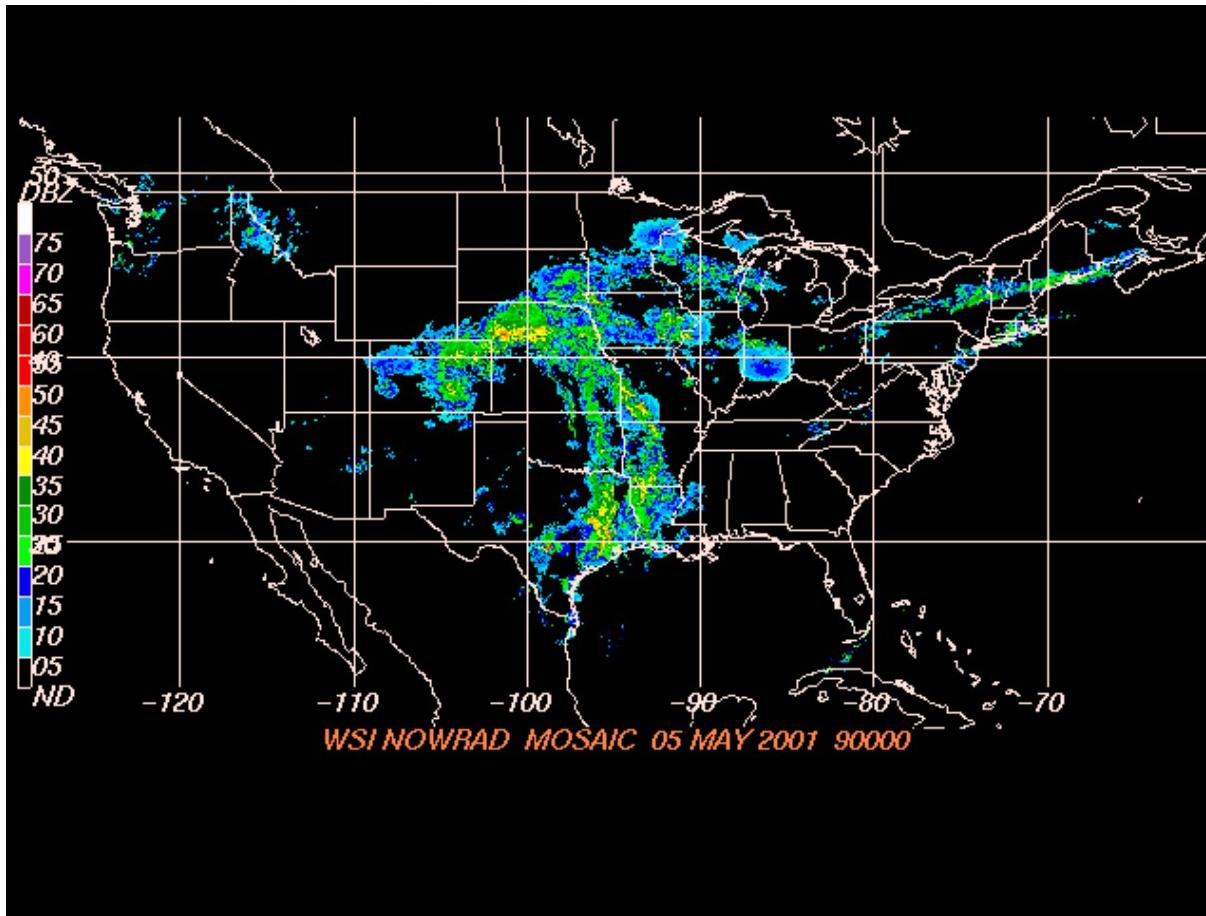
Why?

20010505 06:55:20UTC

Bird echoes on composite Z



Bird echoes on composite Z (May 5, 2001)



Why they are bird echoes

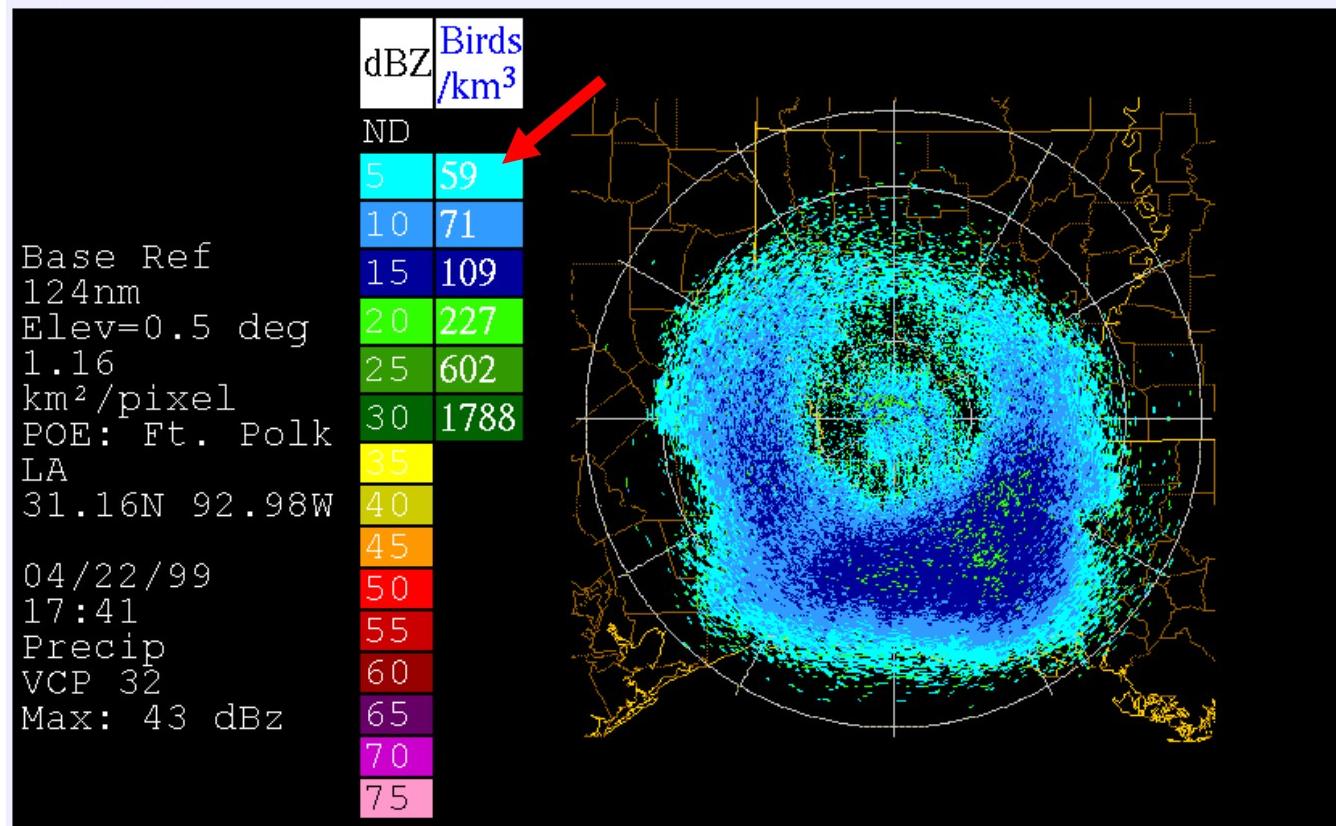


- Previous radar observations and investigations
- Ornithological studies
- Polarimetric radar observations and investigations

Previous radar observations and investigation 1



Precipitation mode base reflectivity image of birds overflying POE Ft. Polk, Louisiana.

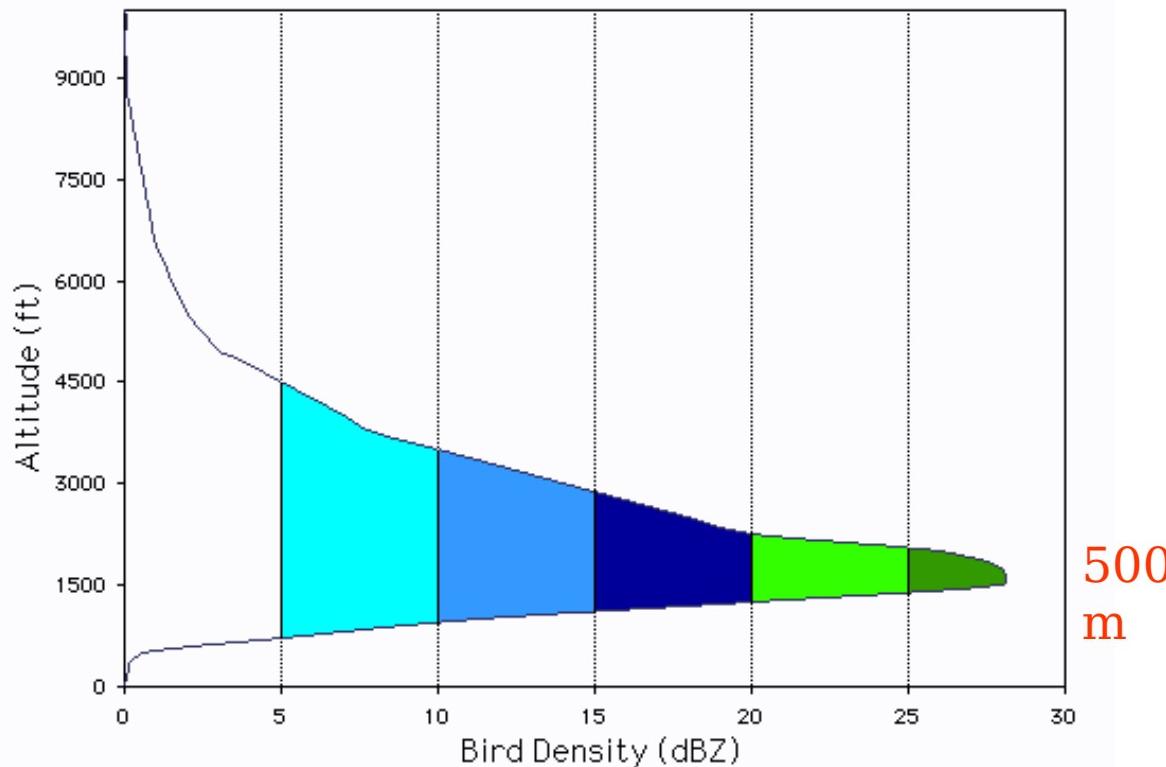


<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 2

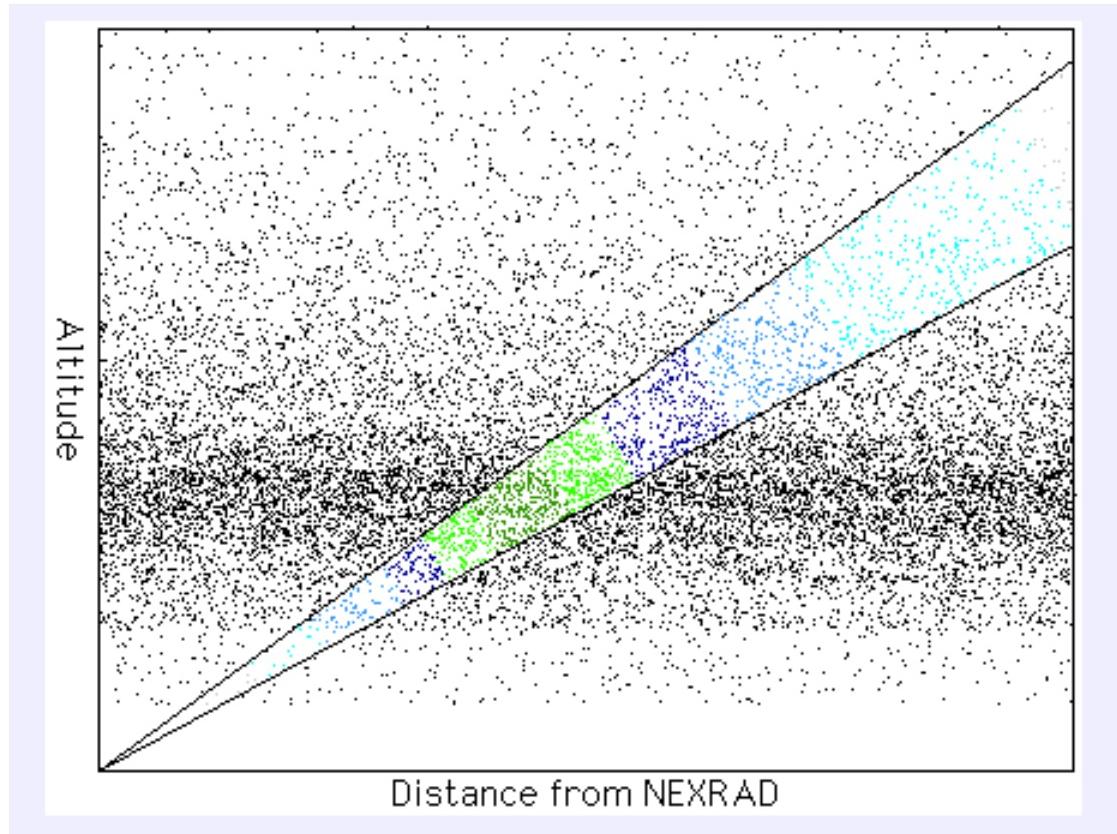


Typical distribution of migrants with altitude



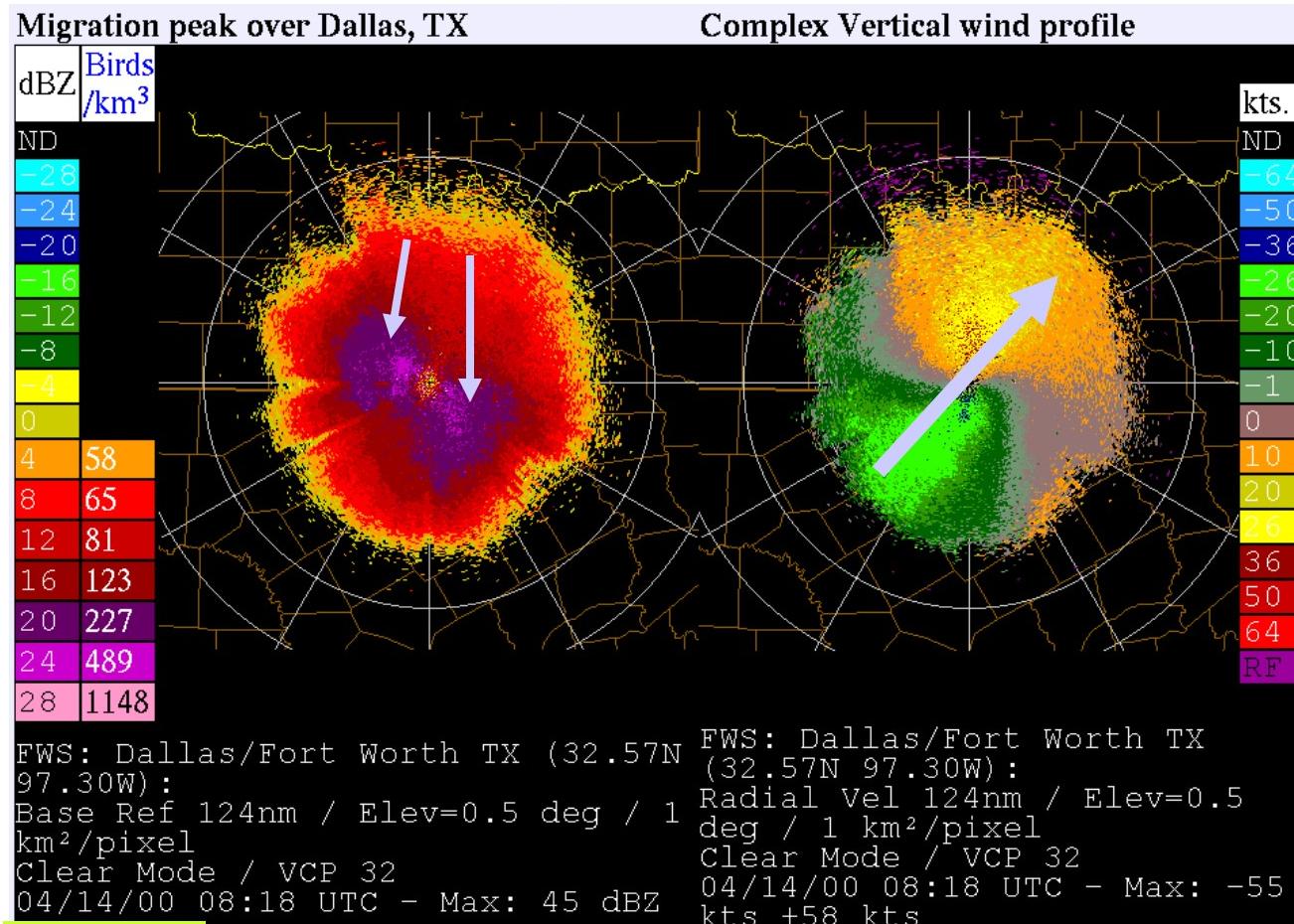
<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 3



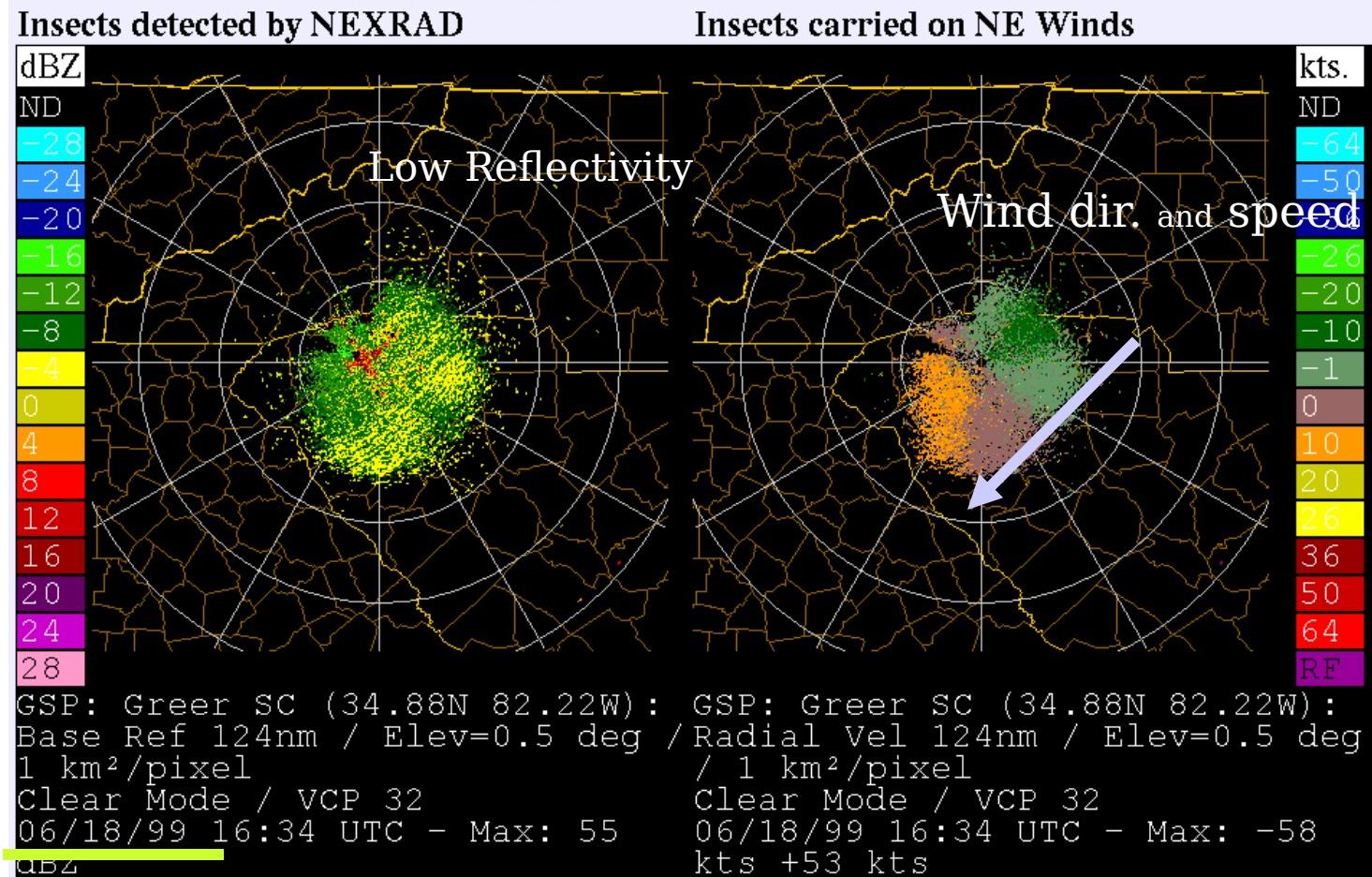
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Previous radar observations and investigation 4



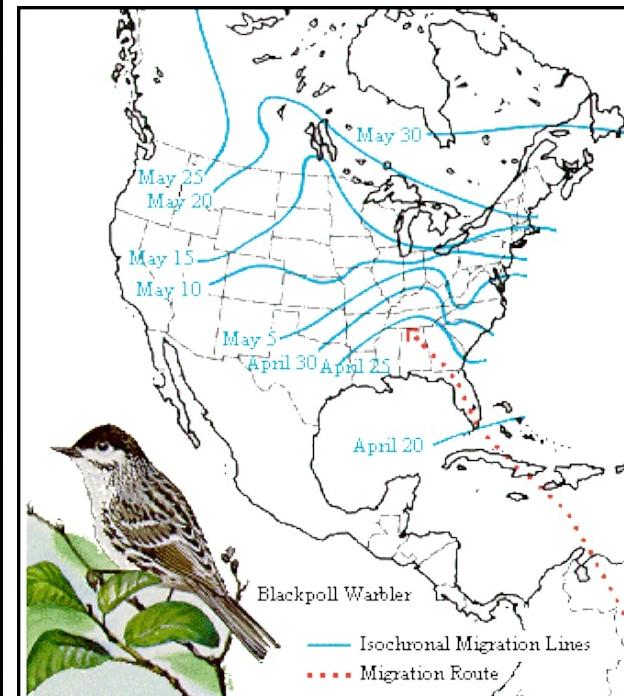
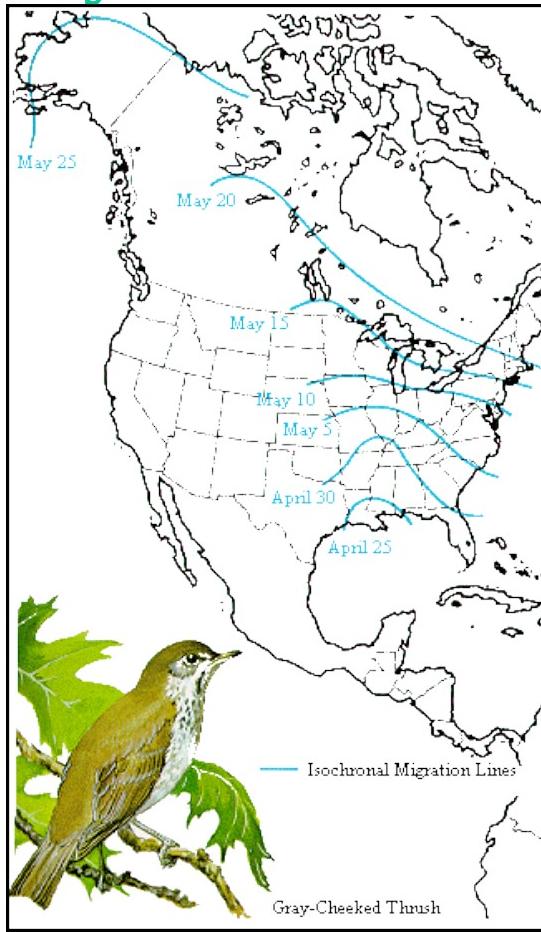
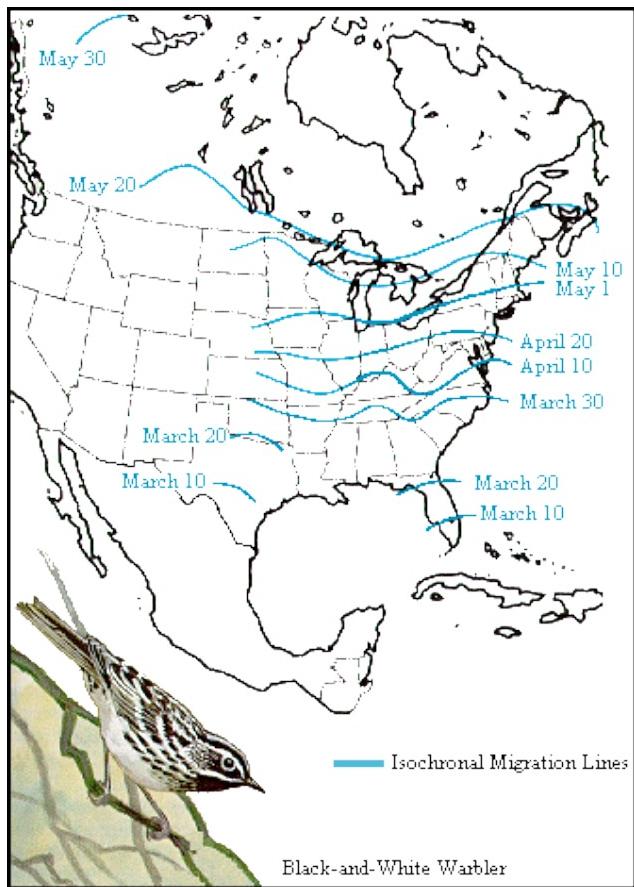
<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Previous radar observations and investigation 5



<http://virtual.clemson.edu/groups/birdrad/COMMENT.HTM>

Ornithological studies: Bird migration path and time of year



<http://www.npwrc.usgs.gov/resource/othrdata/migratio/migratio.htm>

Ornithological studies: Bird migration time of day



What time of day birds migrate?

Night!

Why?

- * avoid their enemies
- * cooler temperature than daylight
- * entire period of daylight to alternate feeding and resting

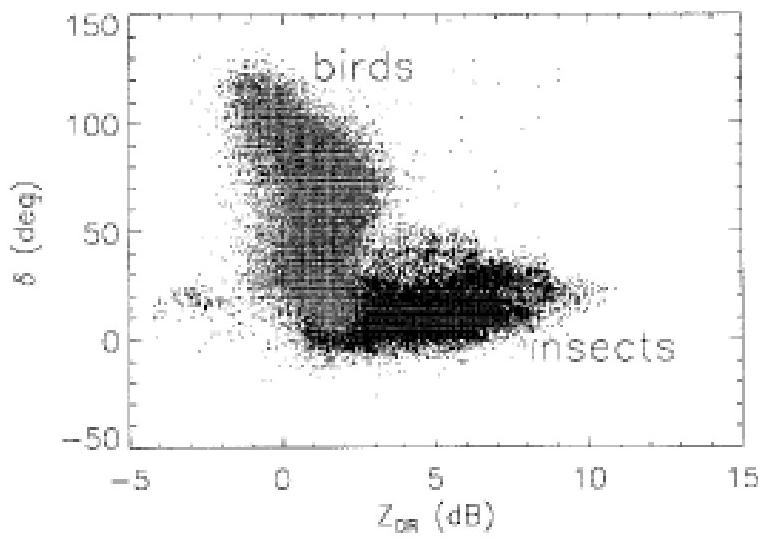
<http://www.npwrc.usgs.gov/resource/othrdata/migratio/migratio.htm>

Ornithological studies: some facts of migration



- Migrating during the night
- From South to North during the spring
- From North to South during fall
- Bird migrating speed 8-12m/s
- Insect migrating speed 2-6m/s
(passive tracer)

Polarimetric radar observations of birds and insects (Zrnic and Ryzhkov, 1998)



Z_{DR} : Differential reflectivity

φ_{DP} : Differential phase

ρ_{hv} : Correlation coefficient

For birds:

Z_{DR} : up to 10dB

φ_{DP} : sometimes over
 100^0

For insects:

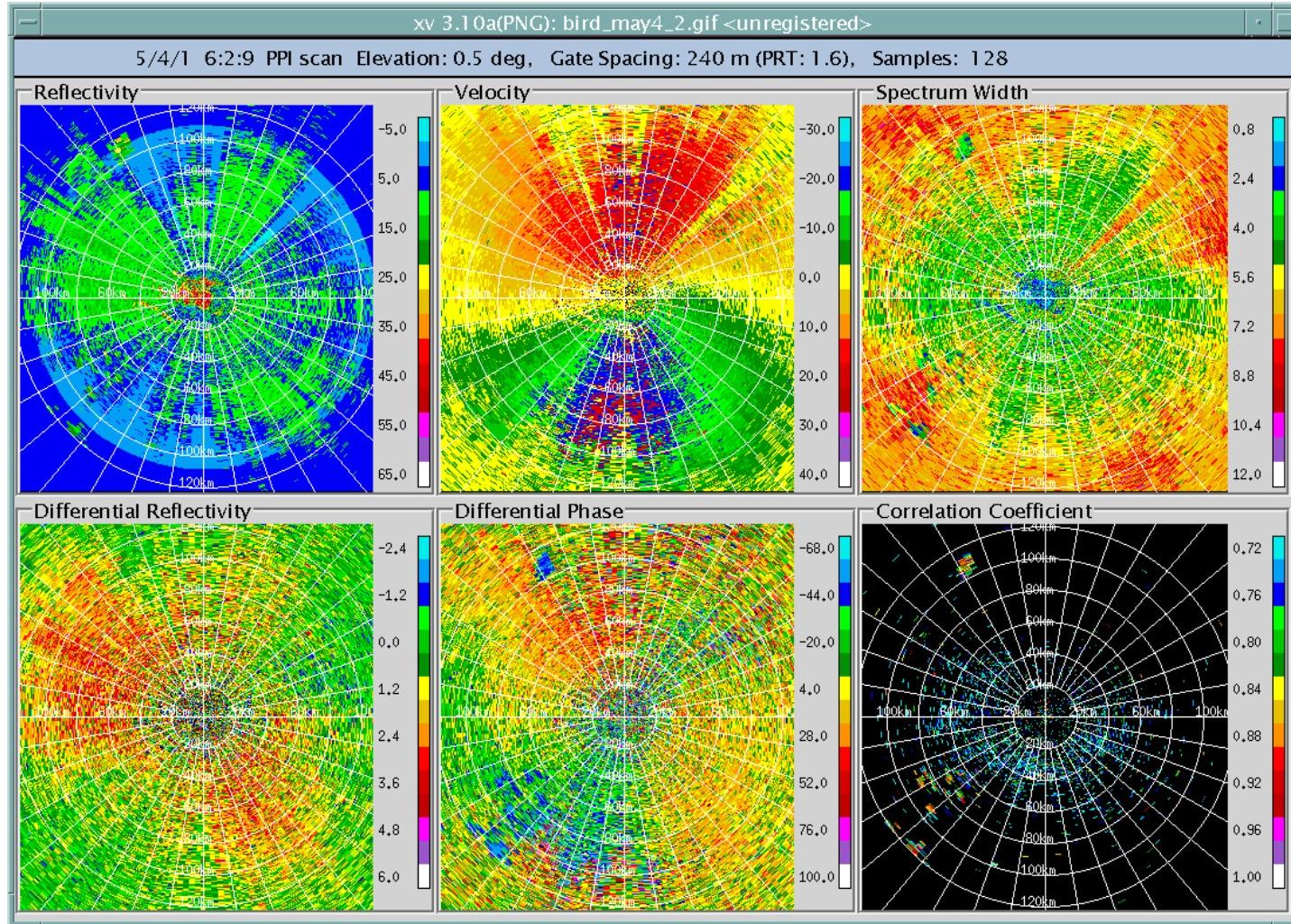
Z_{DR} : between -1 to 3dB

φ_{DP} : less than 40^0

ρ_{hv} : 0.95 to 1.0 for
weather

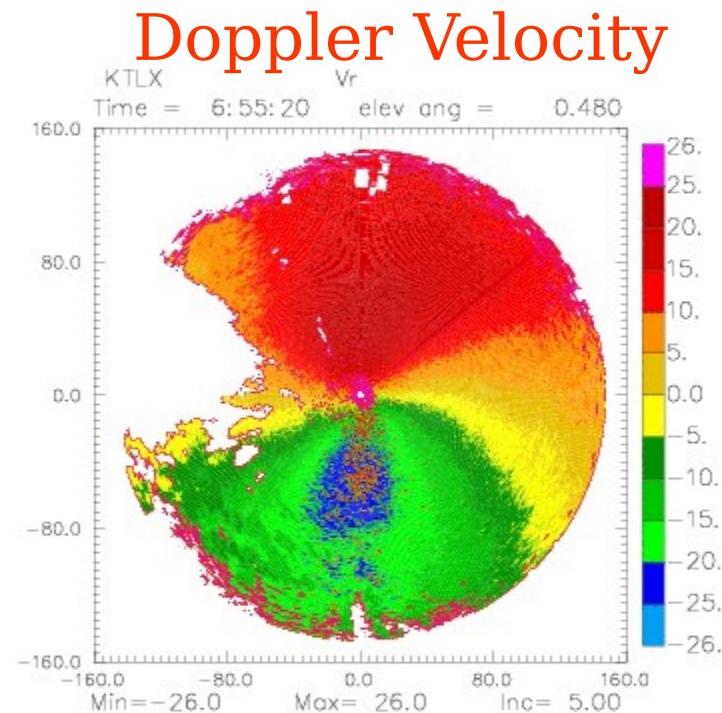
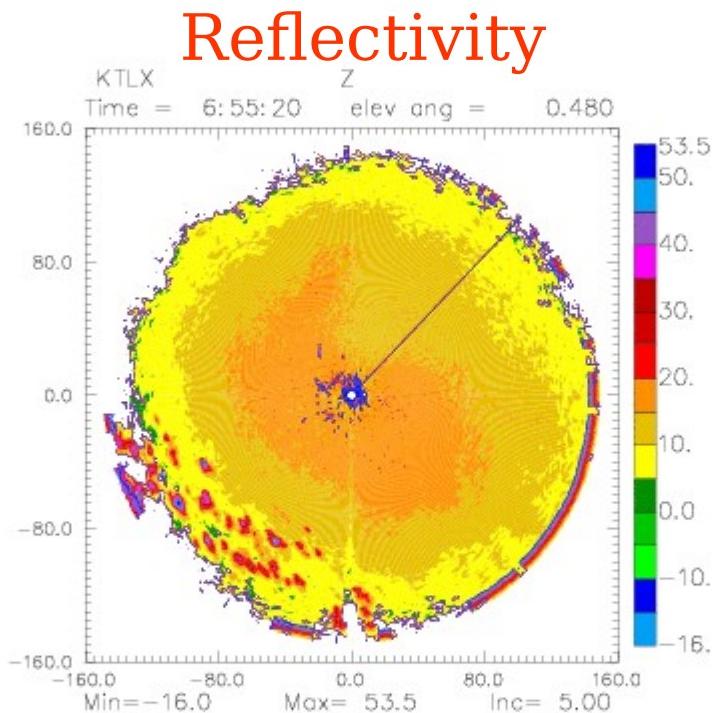
ρ_{hv} : less than 0.80 for
birds and insects

Polarimetric radar observations



NEXRAD Observations of birds

KTLX (06:55 UTC May 4, 2001)

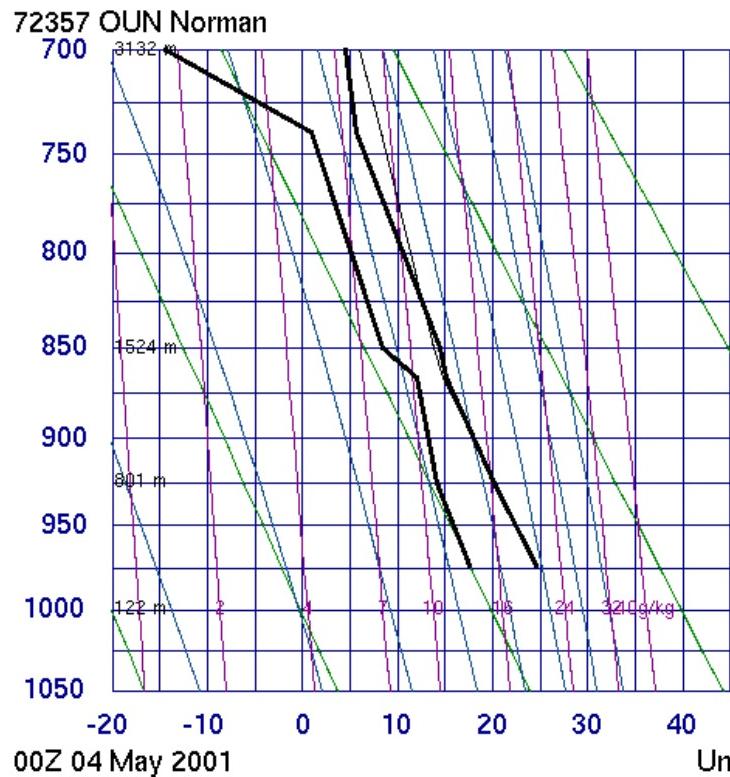


Sounding

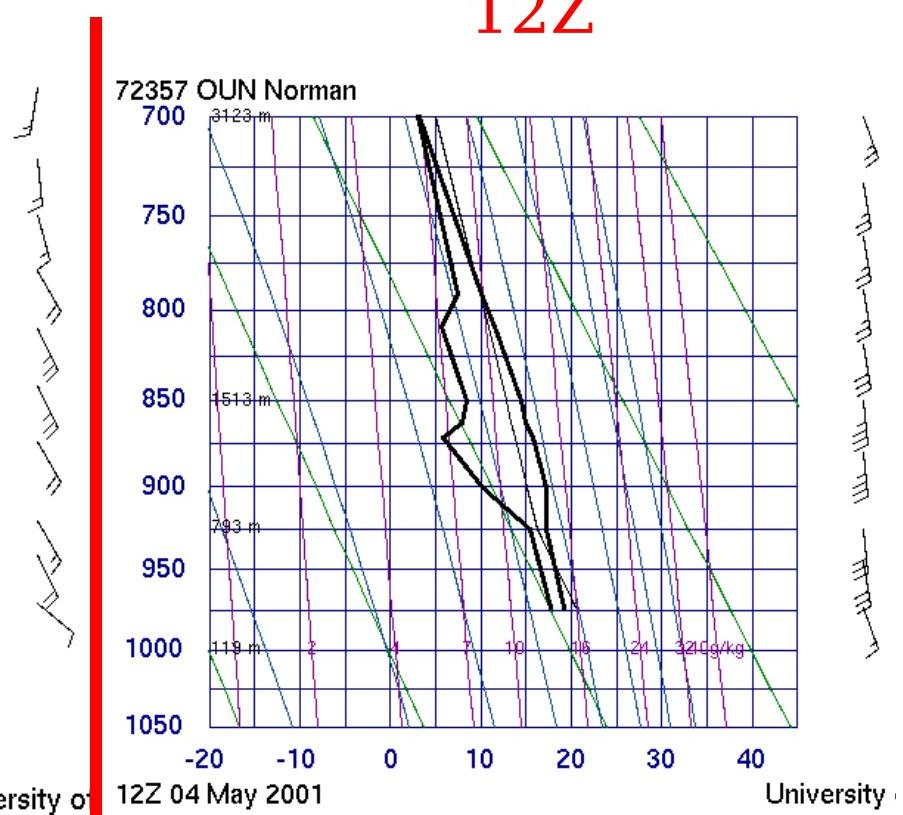
00Z and 12Z May 4, 2001 OUN



00Z



12Z

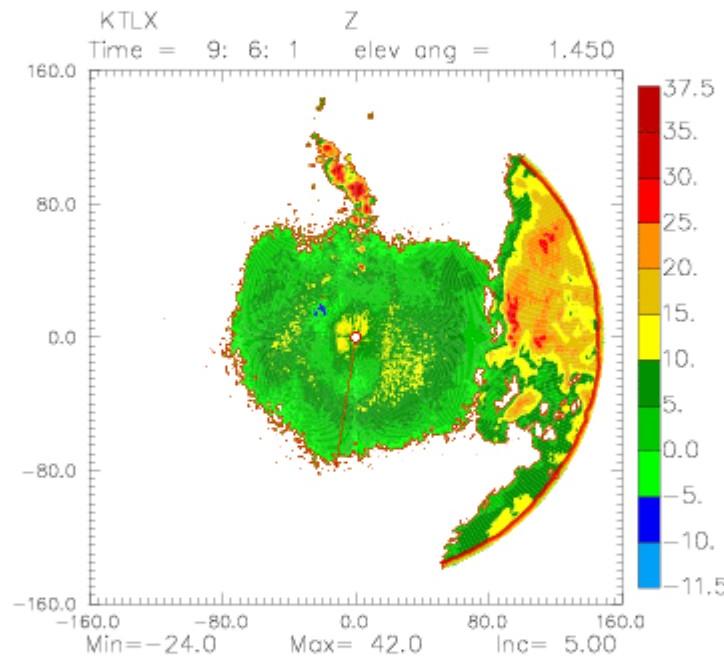


NEXRAD Observations of birds

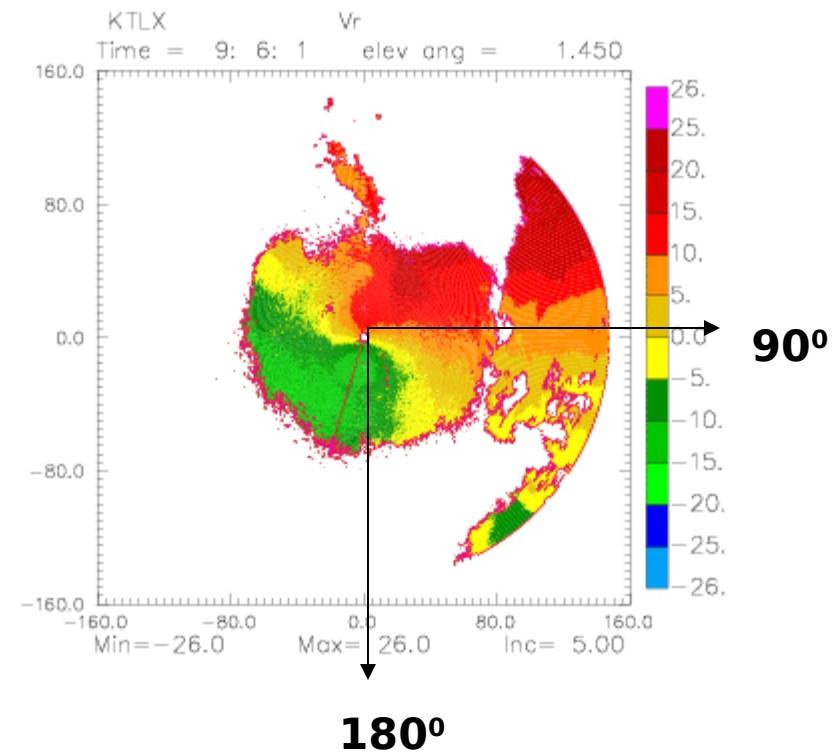
KTLX (09:06 UTC May 5, 2001)



Reflectivity

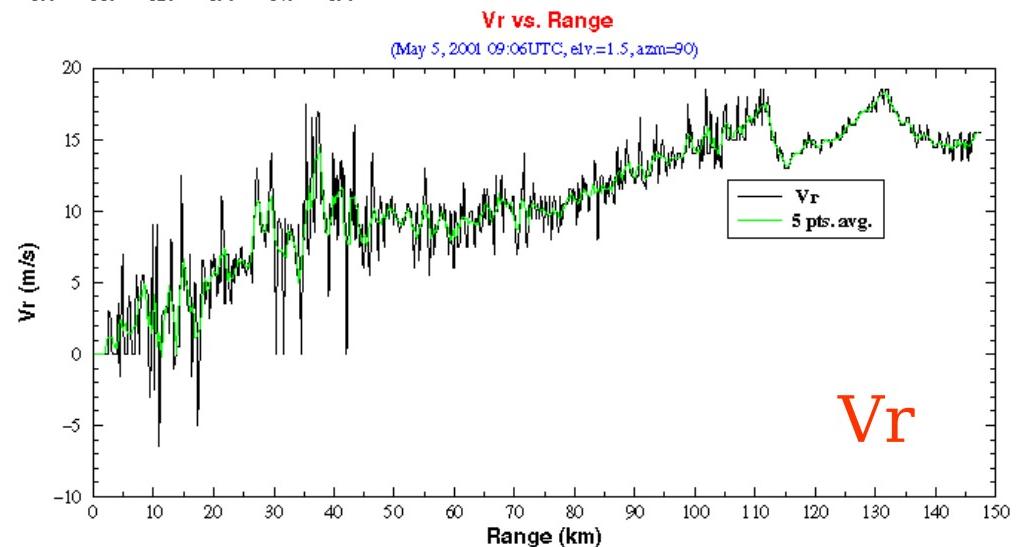
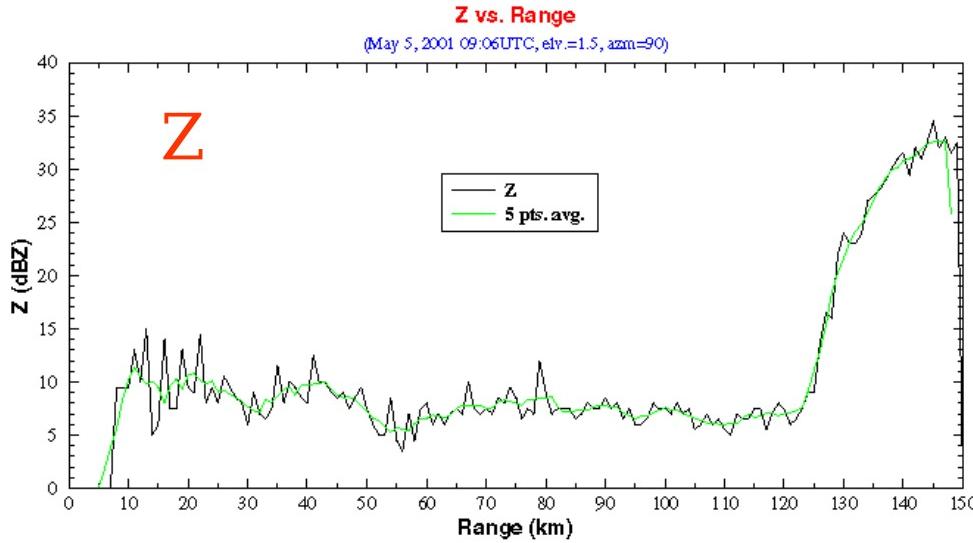


Doppler Velocity



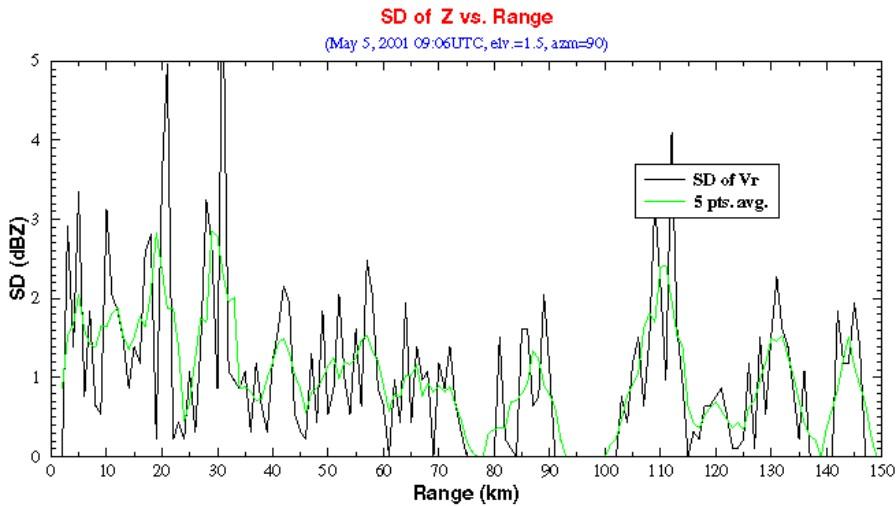
Z and V_r along a beam

azm = 90°



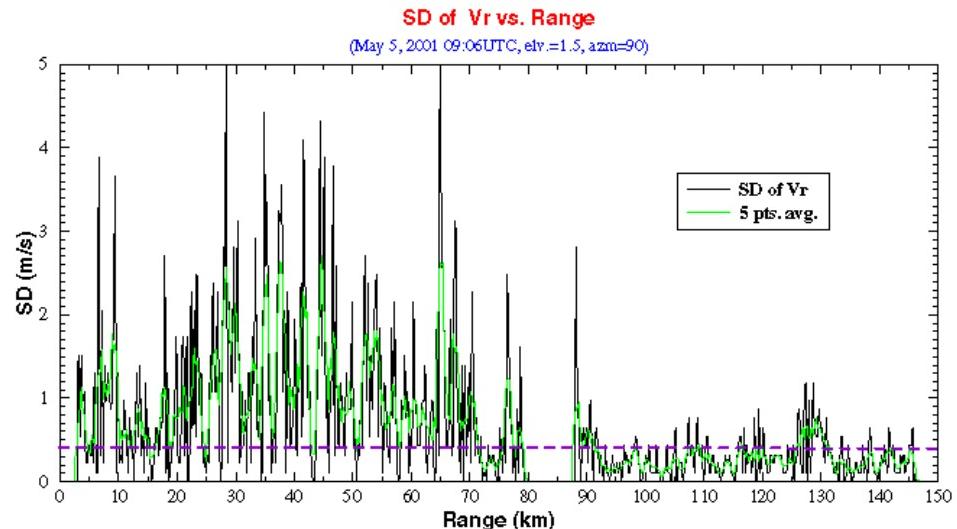
SD of Z and Vr along a beam

azm = 90⁰



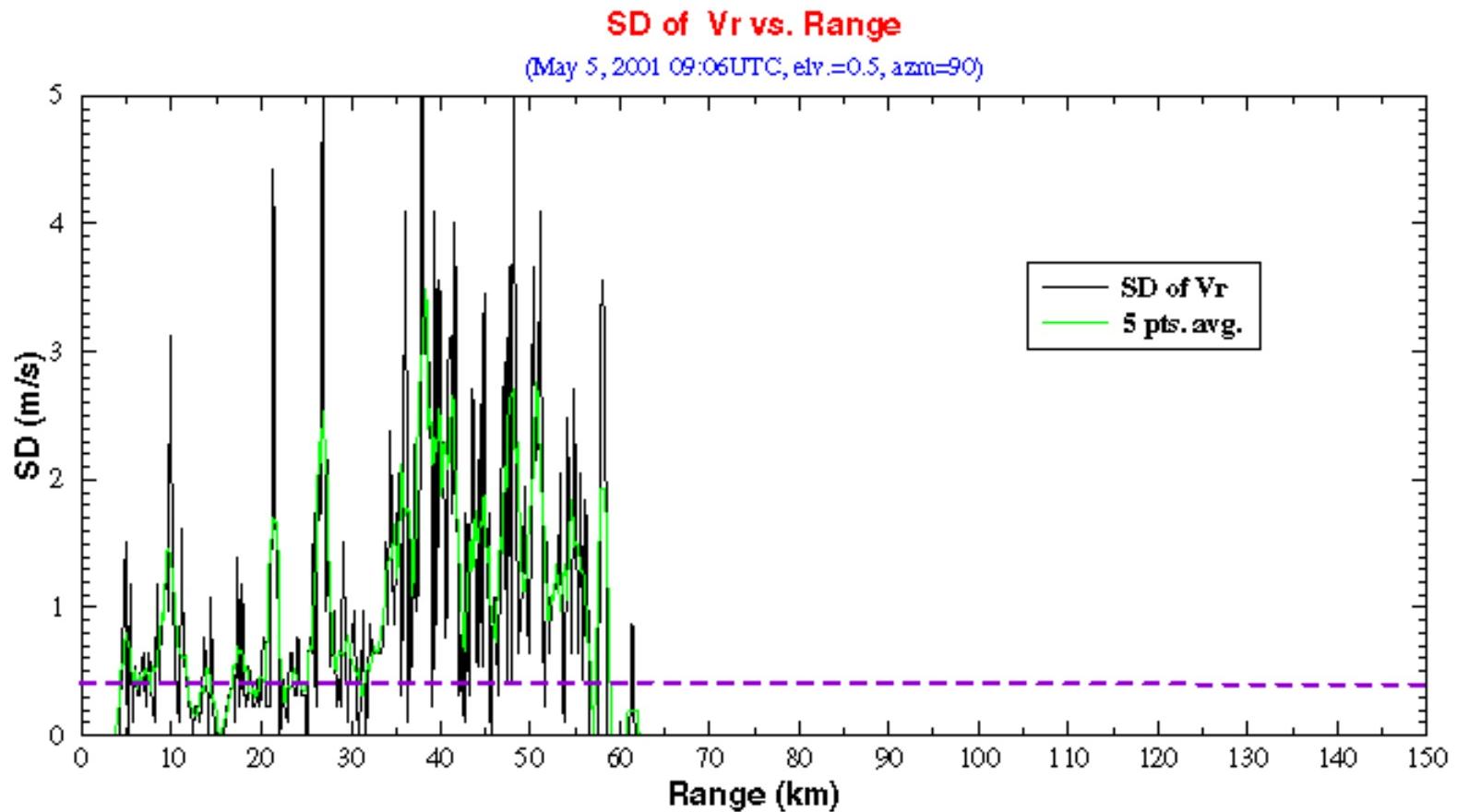
SD:
Standard
Deviation

Texture of radar
data

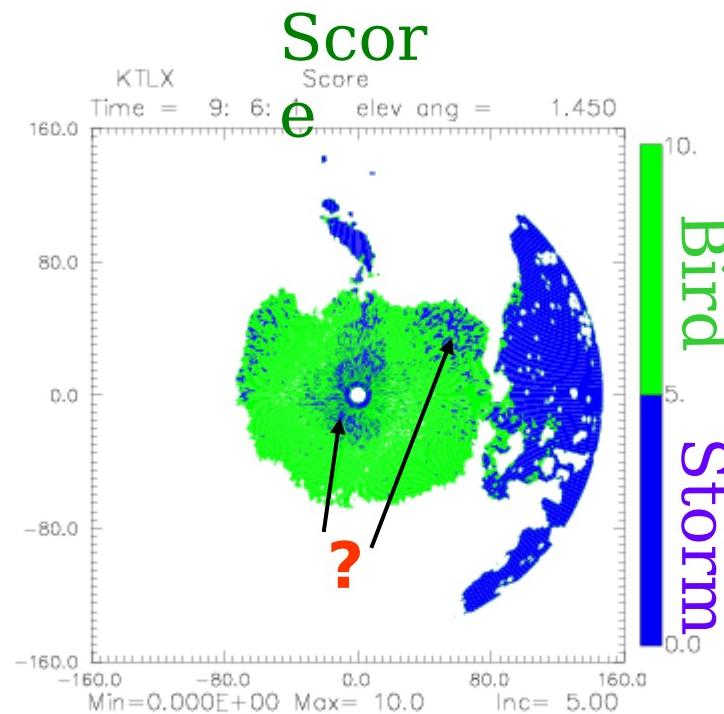
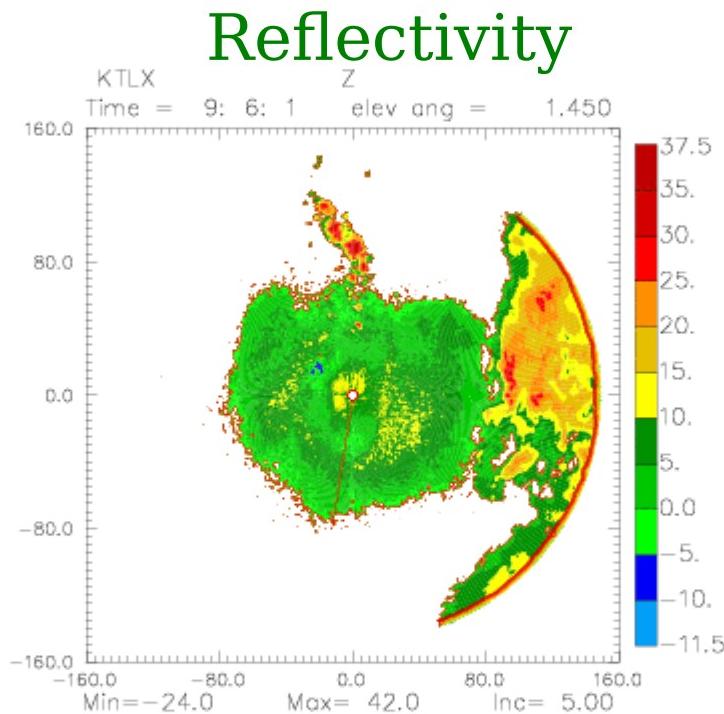


SD of Vr along a beam

azm = 180^0



Preliminary Results of Discrimination



Summary and Future Work



- Automatic discrimination is feasible
- Can be used on other scatterers

More work need to be done:

2D and 3D detection

Ornithological
information, fly speed,
direction, height....